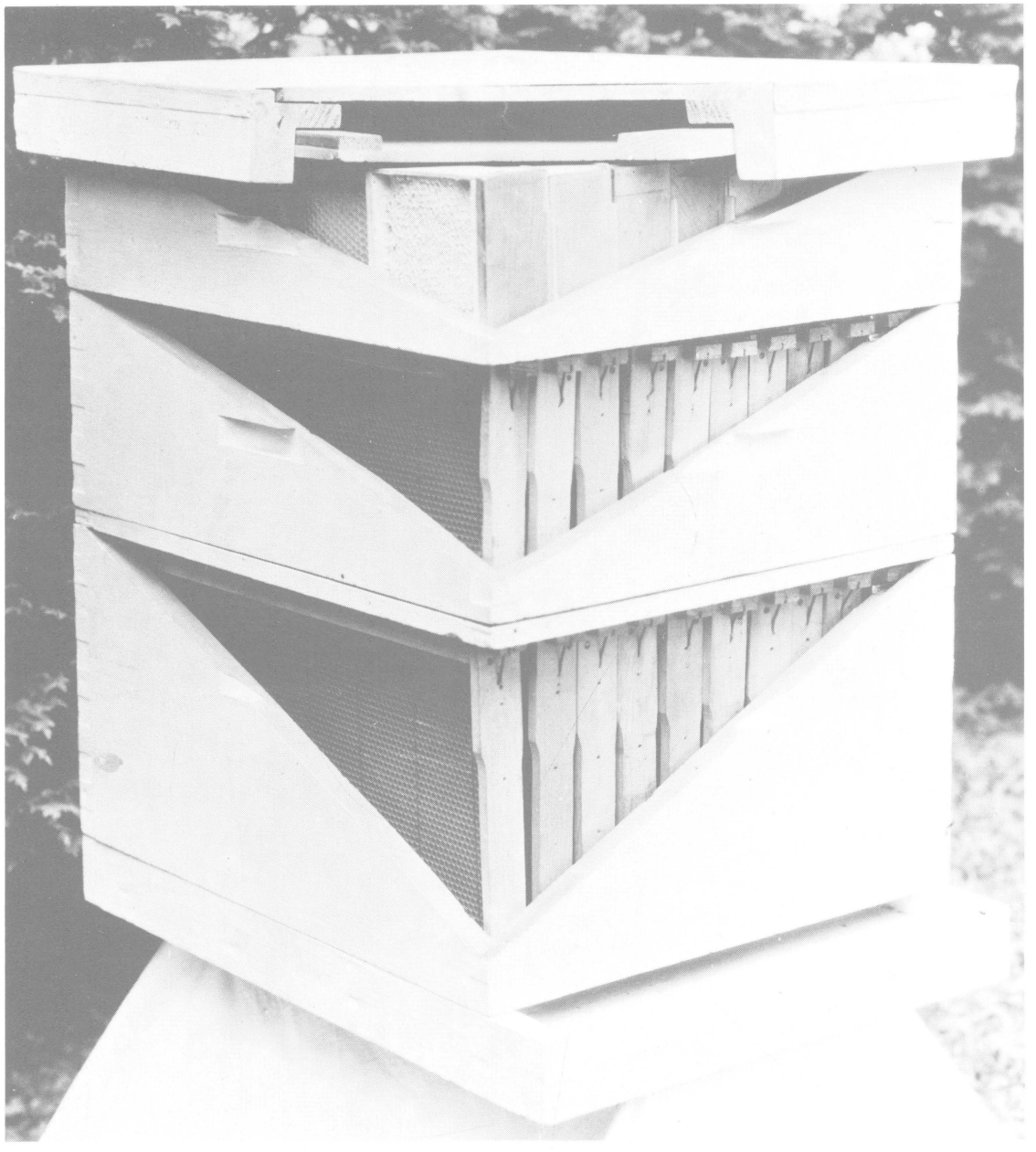
Bulletin 587
Agdex 616

BEEKEEPING EQUIPMENT

COOPERATIVE EXTENSION SERVICE / THE OHIO STATE UNIVERSITY



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INTRODUCTION

Successful beekeeping requires efficient equipment, although attitudes toward equipment may differ with hobbyists, sideline and commercial beekeepers. The hobbyist may take great pride in his equipment and may spend considerable time and money to obtain the best; whereas, the commercial operator will carefully weigh costs against quality and years of use against labor to assemble. The sideline operator may use a mixture of both.

To the honeybee (Apis mellifera L) the insect these beekeepers manage, equipment or "housing" requirements are limited. In nature, bees select a solid, secure, dry location, usually of wood, to establish their colony. In this natural "hive", they construct their own honeycomb in the best manner to fit the cavity. Considerable sealing with propolis to reduce exposure is typical of some races. When completely adapted, the bees will have a secure nesting site.

A beekeeper does little more than provide these undomesticated insects a man made home in which he can inspect, manipulate, and manage the bees, by movable frames. He wants a flexible structure with interchangeable parts, which will still meet the brood production and honey productionl needs of the bees.

This bulletin describes the basic requirements in beekeeping equipment for the new or hobbyist beekeeper. Along with this are brief explanations of why certain items are used or constructed in a specific manner. It does not deal with commercial equipment needs for a variety of reasons. Perhaps the best of these is that most commercial operators have clear-cut ideas of their own!

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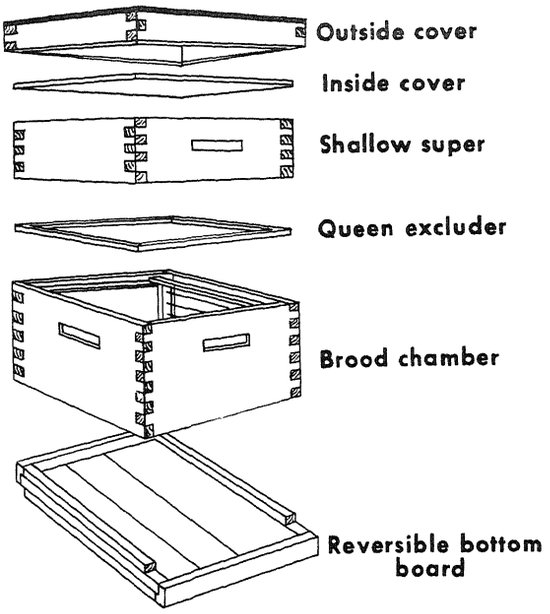
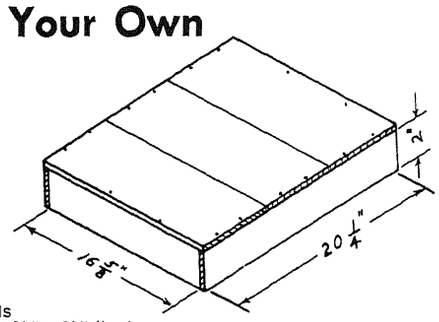
Hive Plans

Commercially Available



Build Your Own

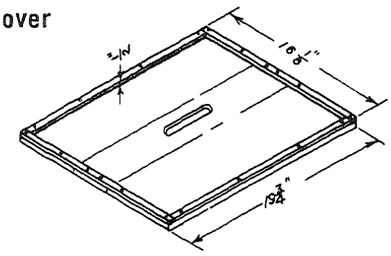
A. Cover



Materials
3 pcs. 7¼" x ¾" x 18" (top)
2 pcs. 21¾" x ¾" x 2" (sides)
2 pcs. 16⅝" x ¾" x 2" (ends)

B. Inner cover

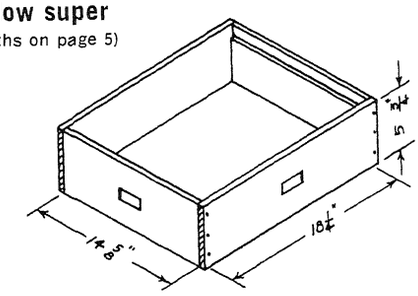
Materials
2 pcs ½" x ¾" x 16⅛"
2 pcs. ½" x ¾" x 18¼"
2 pcs. 6" x ⅜" x 19¾"
1 pc. 4⅛" x ⅜" x 19¾"



C. Shallow super

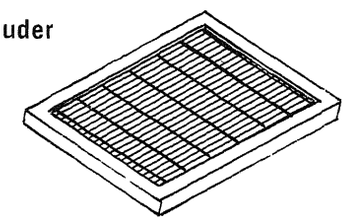
(Other depths on page 5)

Materials
2 pcs. 19¾" x ¾" x 5¾" (sides)
2 pcs. 14⅝" x ¾" x 5¾" (ends)



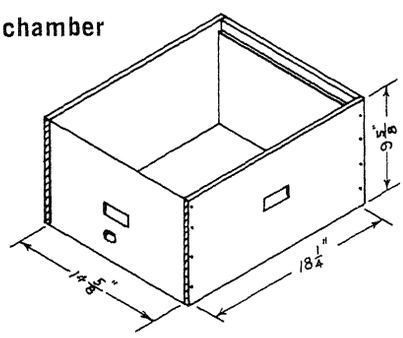
D. Queen excluder

(Recommended beekeeper purchase)



E. Brood chamber

Materials
2 pcs. 19¾" x ¾" x 9⅝" (sides)
2 pcs. 14⅝" x ¾" x 9⅝" (ends)
2 pcs. tin 14½" x ⅞" for rabbet, see rabbet, page 6



THE HIVE

Outer Shell

The beekeeping industry in North America has settled upon one standard sized hive, the Langstroth hive.[1] There are four common depths (or heights) of this hive, three of which may be used by the beginning beekeeper. They are:

Deep hive body: This unit is 9⅝ inches high. It is used most often for brood production. The large units keep a queen bee laying large, solid brood areas with minimum interruption. A disadvantage is that when filled with honey, the deep hive body often exceeds 60 pounds in weight.

Medium depth super: At 6⅝ inches high, this super is a maverick size to the equipment manufacturers, because it cannot be cut efficiently from standard lumber sizes. Still, it is an ideal combination of depth and weight. Individuals with back problems or other health considerations often select this size.

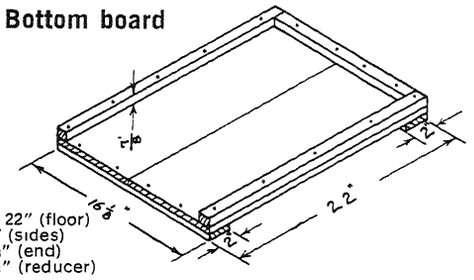
Shallow depth super: This is the standard honey super and is 5¾ inches high. While it is the lightest unit to manipulate (about 35 pounds, when filled with honey), the shallow has the greatest cost of assembly per square inch of usable comb space.

Section Honey super: This super is 4⅝ inches high. It is used to produce honey in basswood section boxes. This process is becoming more and more uncommon, because fewer areas of the countryside provide the sudden, intense flow of nectar required to fill these section boxes quickly. Many areas are now better suited to liquid honey production or, at best bulk comb or cut comb production.

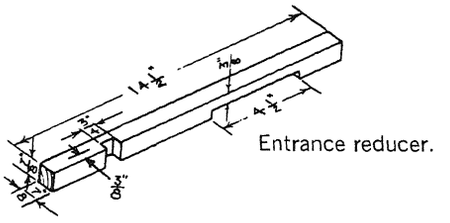
[1] Other sizes are encountered—The Dadant, Modified Dadant and Jumbo. Because they are larger and weigh more, the industry has used them less.

[2] Called super because it is superior to brood chamber, which is usually a deep hive, but not always.

F. Bottom board



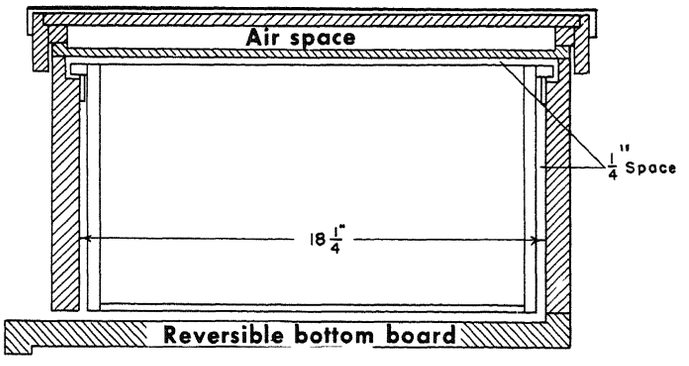
Materials
2 pcs. 8 1/16" x ¾" x 22" (floor)
2 pcs. ⅞" x ¾" x 22" (sides)
1 pc. ⅞" v ¾" x 14⅝" (end)
2 pcs. 2" x ¾" x 16⅛" (reducer)



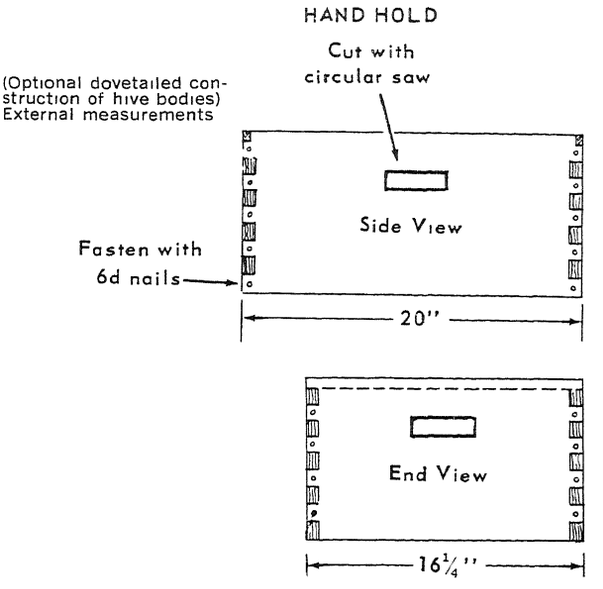
Entrance reducer.

G. Cross section of hive body and frame

(Shows space arrangement of parts)

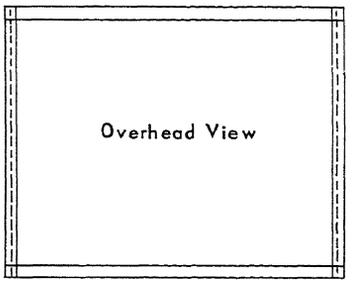


H. Side and end views



I. Overhead view

(Notch end pieces ⅜" wide x ⅝" deep—see rabbet diagram, page 6



Use 1" milled lumber (¾" actual thickness) for construction.

Bottom

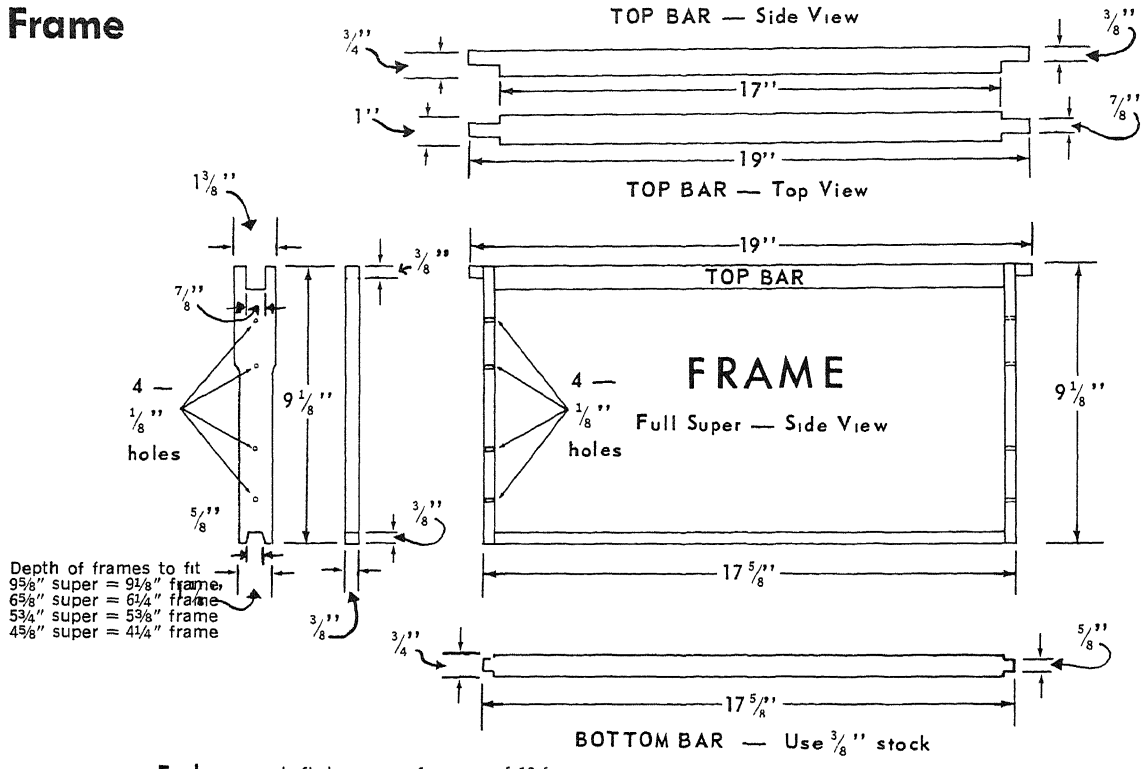
The bottom board serves as a bottom as well as a take-off and landing platform for forager bees. Bottom boards, available from many bee supply companies, are reversible. Plastic bottom boards are available from some companies but lack extensive field testing for long term acceptability. Most beekeepers use a hive stand upon which to rest the bottom board. This may be crude, made of concrete blocks or railroad ties, or it may be rot-resistant cypress. Sometimes beekeepers lay a piece of metal or wood in front of the entrance of the hive to reduce weed growth at the entrance.

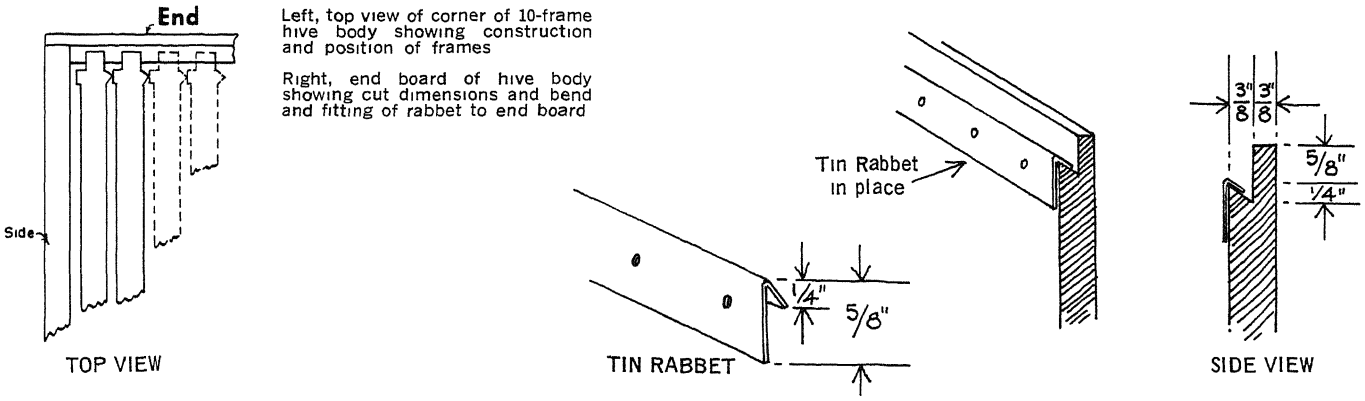
Top

The top of a hive must protect the hive as well as permit upward ventilation. Warm humid air produced in the brood area and where honey is being ripened is exhausted at the top of a properly ventilated hive. In the eastern United States, one usually finds a two piece cover, a thin inner cover of the same dimensions as the hive and a telescoping, outer cover which fits loosely over the inner cover and the top hive body. The inner cover has a ventilation hole, which should not be closed off, unless other ventilation is provided.

In western states, many beekeepers use a simple cover, which overlaps in the front and back but not along the sides. This allows good ventilation, easier moving, and efficient space use on vehicles when moving hives. Less insulation is provided by the single cover, compared to the double cover, because the former lacks an air space.

Frame





Frame — The Working Unit

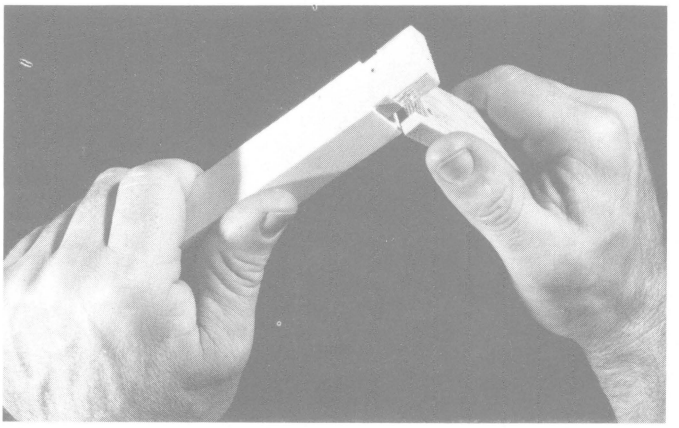
The previous mentioned equipment provides bees a satisfactory, protected home. When given only the outer shell, top, and bottom in which to build a home, they will construct a well braced, complex set of honey comb which beekeepers call **cross comb.** This comb is totally undesirable for a successful beekeeping operation. Successful beekeeping involves the successful management of the bees, and in order to manage these insects, the beekeeper must have the bees in movable units. The frame serves this purpose.

The **frame** permits the beekeeper to take advantage of the fact that honeybees will not build comb in any space of about ⅜ inch in size. This is called the **bee space.** Beekeepers know that bees will "respect" pieces of equipment situated this far apart. In spaces smaller than ⅜ inch, bees will not work successfully. In spaces greater than ⅜ inch, they will build cross or brace comb, thereby making frame manipulation difficult.

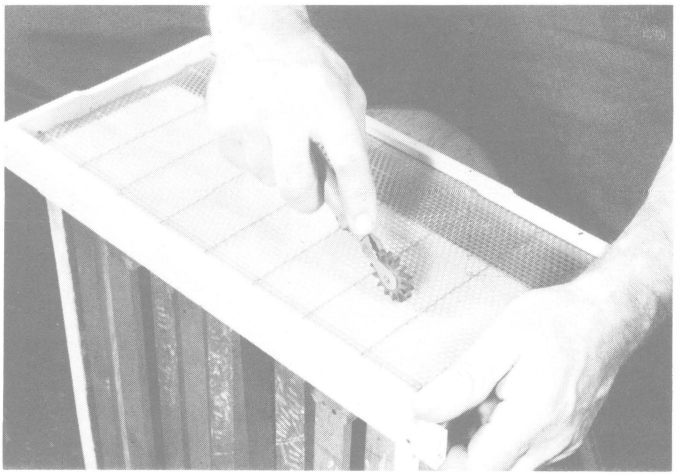
Frames come in sizes to fit the corresponding hive bodies and consist of two parts— the wood (or plastic) support, and the wax comb. To the new beekeeper, the sight of the unassembled frames in the shipping carton is often a discouraging experience, but proper assembly of the wooden frames, using glue to insure long-term handling power, is rewarding in longer use and higher production.

The wax portion of the frame starts as a sheet of prepared beeswax **foundation,** which has been milled to serve as a start for worker cells. Given their own preferences, many colonies will produce considerable drone comb, with larger sized cells. This is considered unprofitable by many beekeepers. Foundation should be installed according to the manufacturers instructions and should be secured with metal pins or preferably with horizontal wires by using a frame wiring device. Foundation is available now with wire reinforcement, plastic centers, thread reinforcement, and other options. Reinforced foundation is necessary for brood combs and for comb which will be extracted for liquid honey production. Thinner, unreniforced 100 percent beeswax foundation must be used for cut comb honey and section honey production.

Undrawn foundation should be given to a rapidly growing unit of bees such as a package colony, swarm, or colony split. It may be given to an established colony



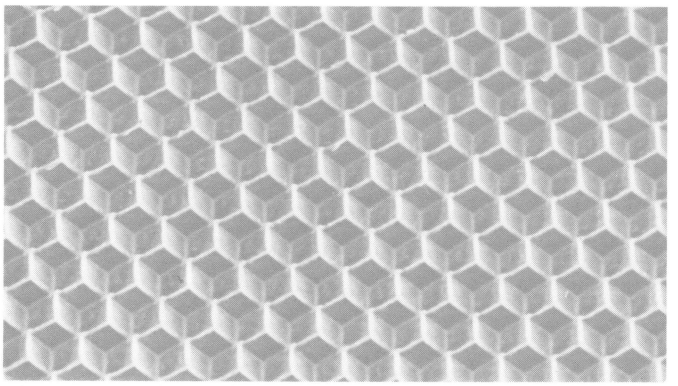
Frame corner assembly



Embedding wires

Frame assembly

Inspection of drawn comb with brood



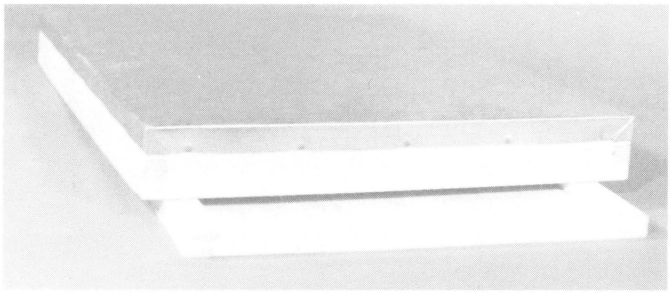
Wax foundation (closeup)

when a strong flow of nectar is present. When given to a strong colony without a flow, the bees will often chew out the foundation, causing considerable loss to the beekeeper.

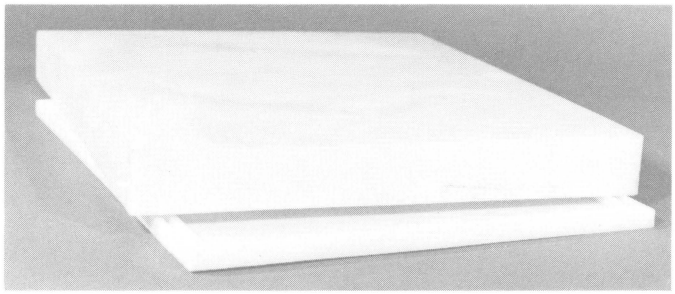
Bees do not actually pull or draw out the existing wax. They add additional wax to produce the wax honeycomb. When used for brood production, larvae spin the cocoon in the cell and defecate there. This material is not removed, and cells gradually darken. This does not make them unsatisfactory for use and they may be used for many years. Buckled combs, broken wax, or split frames often signal the time for replacement.

Frames used only for honey production will remain light in color for many years and may be repeatedly uncapped and extracted to remove the honey. Because honey stored in dark brood comb will darken significantly, some beekeepers try to keep the frames used for brood production and those used for honey production separate in the hive. One way to do this is to use a **queen excluder,** which allows worker bees to pass through but not the queen. Excluders are also used in two-queen systems, where the two queens must be kept separate.

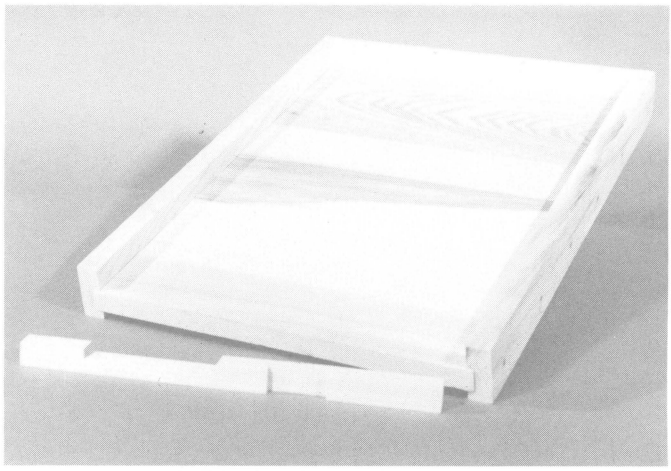
Beginner Hive



Wood cover (top) and inner cover

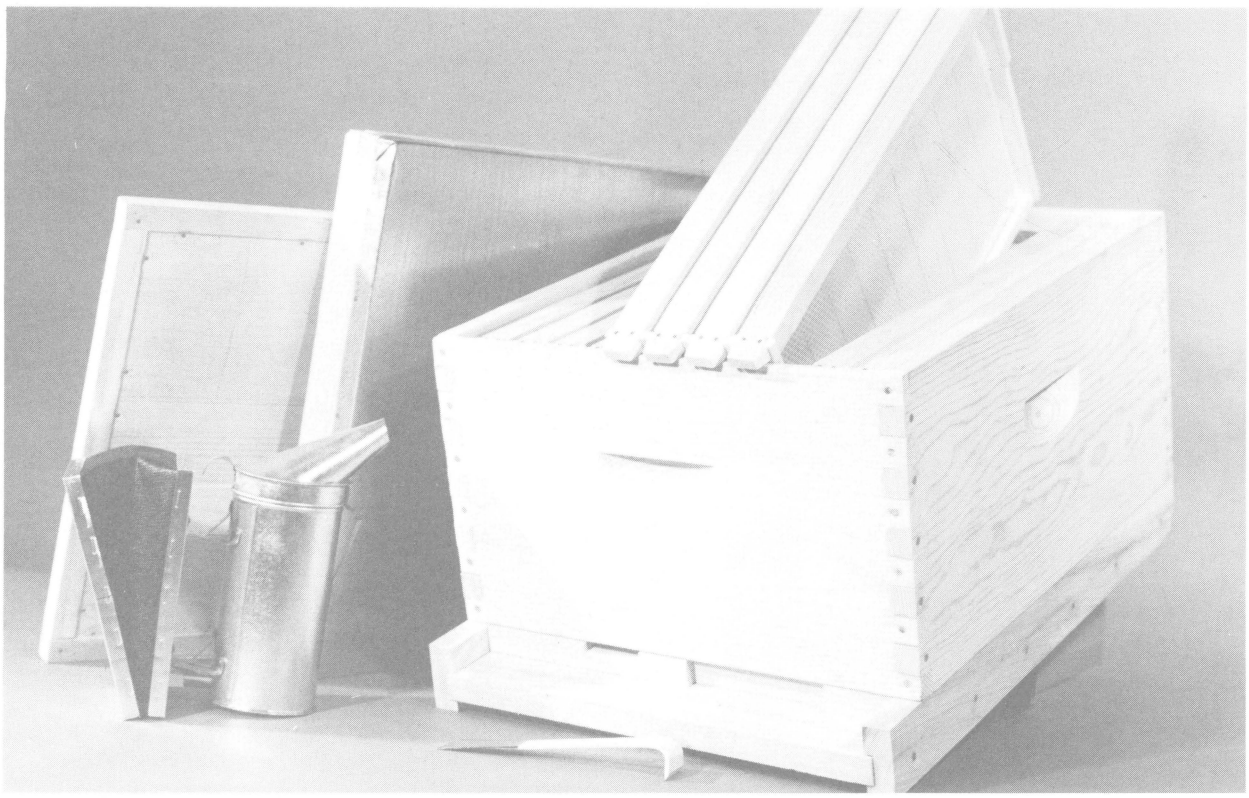


Plastic cover (top) and inner cover



Bottom board and entrance reducer

Brood chamber (hive body)



Hive body, bottom board and reducer, frames with wax foundation, top cover and inner cover, smoker, and hive tool

Location provides wind protection for hives during winter

Entrance reducer in place

Preparing Hive for Winter

In nature, bees reduce the size of the entrance hole by using the sticky propolis they gather from tree buds. Beekeepers can reduce the use of propolis at the entrance of the hive by placing an **entrance reducer** in the entrance. Thus, weaker colonies can defend themselves better, and all colonies will have protection from field mice which are attracted to the warmth and food in a hive where the bees are clustered. Some beekeepers use wooden blocks and hardware cloth to achieve the same effect.

By partially closing the "front door", most beekeepers are wise to offer the bees the use of a small **upper entrance.** Usually this is done by drilling a small 7/8 inch hole in the top hive body just under the handhold, not in the handhold. This gives bees a chance to fly in weather when the bottom entrance might be blocked by snow or ice. It also permits increased upward ventilation, an important part of proper winter management.

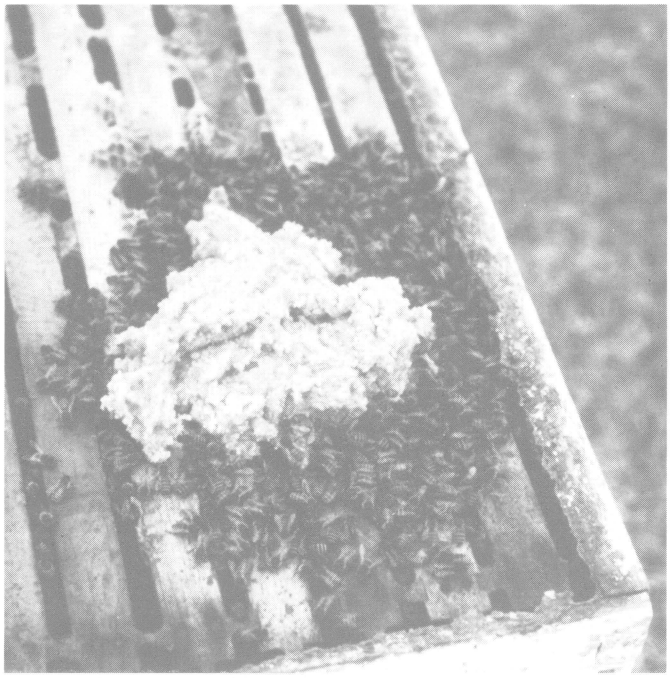
Upper entrance sometimes provided when danger of lower entrance being closed

Feeding Devices

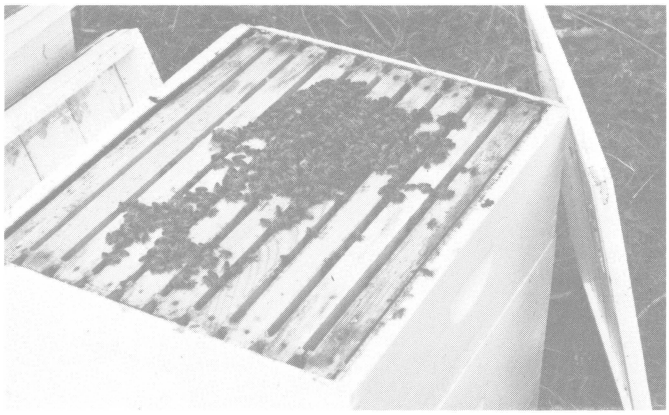
Any beekeeper who considers his operation all "take" and no "give", can greatly improve his operation by feeding weak or new colonies at times when needed. Two types of food may be fed—sirup and pollen.

Sugar sirup may be fed in pails with perforated lids

Feeding with friction-top pails



Pollen patty feeding



Late winter cluster

Boardman type feeder

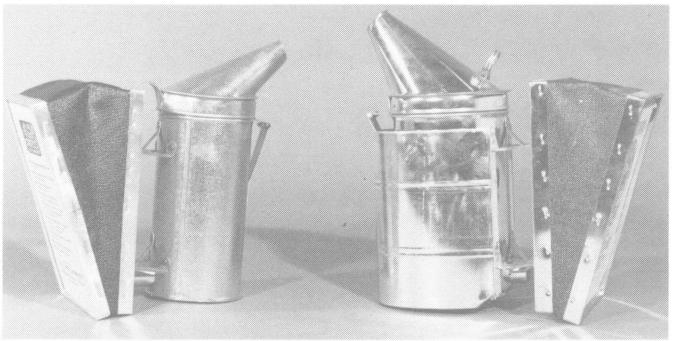
Feeding by pouring sugar on inner cover

placed over the combs as extra stores in the fall and as subsistence and stimulative feeding in the spring. A large **plastic bag** may be placed around an empty frame and secured with string or rubber bands. When filled with sirup, bees are able to crawl to the sirup without risking drowning.

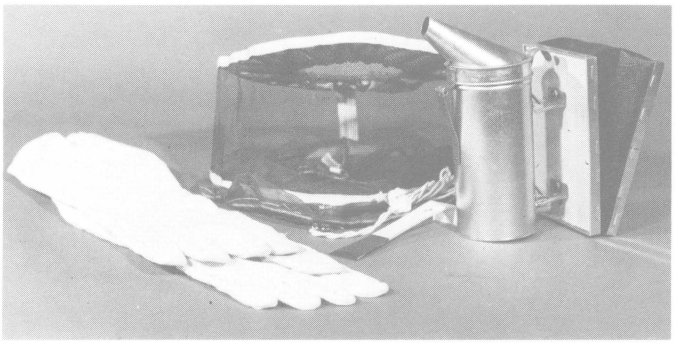
Many beekeepers have a front entrance feeder called the Boardman feeder. This provides the beekeeper a quick way of feeding sirup. However, it is not visited by bees during cold weather and often starts robbing by neighboring colonies in warm weather.

In an emergency, dry sugar may be poured on the inner cover, allowing the moisture of the bees to dissolve the sugar and make it usable. This should be used in emergencies only.

Pollen or pollen substitute feeders are very useful. The dry, powdery materials may be attractive to the bees when pollen supplies are short in the comb. However, most beekeepers prefer to make a dough-like mixture of pollen substitute and sugar sirup, which is shaped in cakes and placed over the brood area of the colony. Starting with a small amount in the late winter, the size of the cake is increased as the brood area increases. Pollen may be trapped during peak pollen flows (June and September) or a pollen substitute may be purchased from supply dealers. This is usually better than the beekeeper mixing the material himself. A pre-packaged blend of pollen, sugar, essential nutrients and vitamins, is marketed in some areas for feeding.



Two types of smokers



Veil, smoker, hive tool and gloves

Tools of Beekeeping

The **bee smoker** produces white, cool smoke to help the beekeeper manage the bees. Smoke apparently stimulates bees to fill their honey stomachs with honey, making them less aggressive. In addition, the smoke probably also interferes with the communication system of the bees. Many items are used in smokers as fuel—anything which produces a cool white smoke is fine.

The **hive tool** is a specially designed piece of steel, essential for separating frames and scraping wax and propolis. When used properly, the hive tool will not damage the frames or hive bodies.

The **bee veil** is designed to keep bees away from the beekeeper's head. Several styles are available and personal preference usually dictates which is selected. Some may be zipped into a work suit, making a bee-proof unit.

The **gloves** are made of canvas, usually, or leather. They have long sleeves to protect the arms. Commercial beekeepers rarely use gloves (some rarely use a veil), since they combine proper management with a reduced sensitivity to stings. But to the beginner, gloves provide added protection until confidence and reduced sting sensitivity are developed.

The beekeeper may have other protection as well. Perhaps a combination of boots, light slacks tied at the ankles, comfortable shirt, and a good veil give the best protection with the least amount of discomfort during hot weather.

Beekeepers should not wear fur or woolen items around bees. Light colors seem to be better than dark. One-piece work suits are favorites of many beekeepers and are available in a variety of colors. They are available in light weight for summer, too.

THE BEES

All our discussion about beekeeping equipment is wasted unless we have bees. There are several ways of obtaining bees to start a beekeeping operation. You can buy package bees, an established colony, or start with a swarm.

Package bees may be purchased from commercial beekeepers in southern states who produce packages of bees for shipment to the northern states. Names of such dealers may be obtained from equipment supply companies and from advertisements in beekeeping magazines. Learn how to properly install package bees before attempting to do so.

Usually, established colonies are available on a limited basis from local beekeepers. Equipment is valued

Installation of package bees

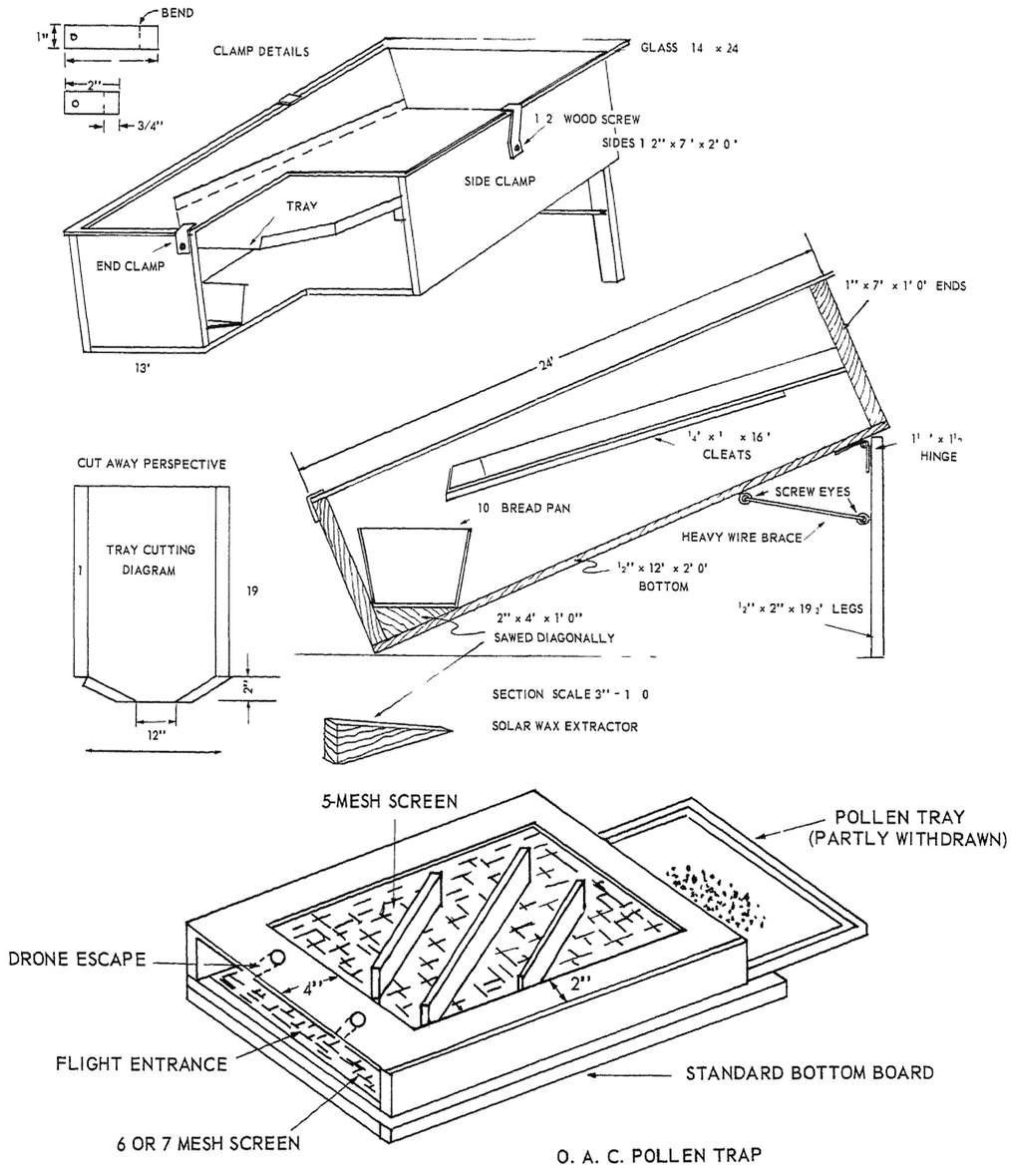
Newly installed package bees

Above, swarm leaving a hive; above right, swarm on branch of tree; below right, hiving a swarm

at the cost of replacement minus the depreciation of the equipment. Carefully inspect such equipment and the bees. **A certificate should be provided by the seller stating that the colonies are free of American foulbrood.** This certificate is issued by the Department of Agriculture, Apiary Section, Reynoldsburg, Ohio 43068.

Collecting a swarm of bees is a cheap way to get started in beekeeping, because there are often abundant swarms in residential areas. A call to your county agricultural extension agent, the local police department, or other agencies will usually alert these individuals that you are interested in swarm removal.

Swarms may be safely handled when located in low shrubs, or similar situations, by shaking the bees into a large sack and then dumping them in front of the new hive. Unfortunately, swarms are temporary. Once bees become established in the side of a building, the job of removal becomes very difficult. This is a task for the experienced beekeeper only.



O. A. C. POLLEN TRAP

OTHER EQUIPMENT

Solar Wax Extractor

Old comb and other wax fragments may be rendered by the beekeeper, using a solar wax extractor. This is a slow processing device and depends upon very clear days to work efficiently, but it conserves energy.

After construction of the equipment, shown in diagram, paint the outside of the extractor with black paint to aid in holding solar energy.

Many beekeepers modify this plan by using a double layer of glass with an air space between to add to the heat generation properties.

Pollen Trap

The Ontario Agricultural College (O.A.C.) Pollen Trap was developed in 1962 to overcome some of the common problems found with other types of pollen traps.

This trap, shown in diagram, is placed on the bottom board of a colony hive. Pollen is collected in a tray beneath the colony where it is protected from the weather.

The colony must be removed from the bottom board in order to install the trap, perhaps the trap's biggest drawback. The bottom board must be reversed and the trap placed so its entrance is in the position of the original hive entrance. Bees will orient themselves to the new entrance. With the bottom board reversed, it serves as a holder for the pollen tray, which may be removed by sliding it from the open end of the bottom board at the rear of the hive.

Construction: Construct the trap to fit on a standard hive stand. The height of the trap is three inches. Other dimensions are shown in the diagram.

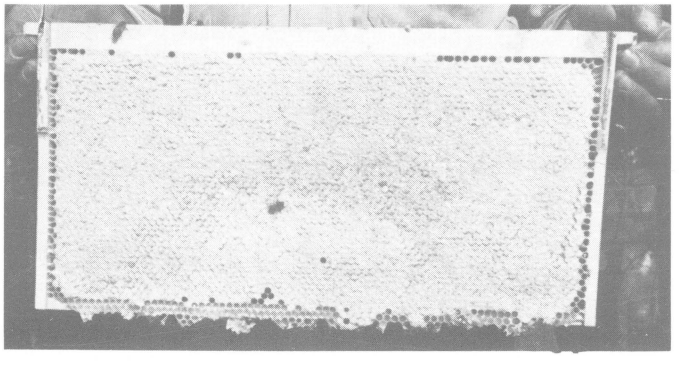
Bees cannot crawl through the six to seven mesh screen, located on the bottom of the trap (which is above the pollen tray), but pollen pellets can drop through onto the tray. As bees crawl through the five mesh screen, pollen pellets drop off, falling through the six or seven mesh screen onto the pollen tray. Pollen pellets spread out on the tray as they fall, thus resisting molding. However, pollen should be removed at least once per week, preferably more often.

"Honey bears" showing different colors of honey

HONEY PRODUCTION

Cut Comb Honey

Production of honey usually is the desired goal of the beginner. But expensive extraction equipment will discourage some, while conditions for section comb honey production are often lacking in many areas where beginning beekeepers are located. Therefore, alternatives are bulk comb or cut comb honey, and mashing and straining the honey.



Bulk comb honey

Bulk and cut comb honey may be produced when unreinforced wax foundation is used in the frame. Bulk honey can be drapped in plastic and sold in the frame. For cut comb honey, the beekeeper needs a clean cutting surface, a knife, and wrapping or packaging materials. The procedure is simple: place the frame of honey (completely capped or partially capped) on the cutting surface. Using a sharp, serrated knife, cut the comb into the desired sizes. Let drain, then wrap the cut honeycomb in clear plastic and place in a plastic box, or put into bottles with liquid honey (drained from the cutting surface) poured around the cut comb to make chunk honey.

By using cardboard or plastic containers, and an attractive label, even the beekeeper producing less than 100 pounds of honey each year can offer a desirable product for sale.

Put new foundation wax in the frames and they are ready for the next honey flow.

When only small amounts of honey are available, remove by crushing or mashing the honey out of the comb, drain into a large container, and allow to settle If a settling tank is available, liquid honey may be drained off the bottom, while the wax remains on top Settling honey in a hot room allows honey to clear

Extracting Liquid Honey

The beekeeper can purchase or rent a small **honey extractor** to remove honey from the comb.

A bee-proof area must be selected as a work area Once a single forager finds access to the work area, this information is communicated to the hive and robbing may start.

Move stacks of supers of honey, both capped and uncapped comb, into the work area Warm air in the work area helps remove the moisture in honey Remove bees from the work area that were brought in on supers or otherwise gained entrance to the area A single window in the area will attract bees, letting them exit through a bee escape or allowing the beekeeper to vacuum them for release outdoors.

A serrated knife may be used to remove the wax cappings. However, a heated knife will make the job easier, if a great deal of honey is to be extracted. Drain cappings of honey and render wax for further use Place uncapped frames in the extractor and remove honey by centrifical force After removing a little honey from one side, reverse the comb and empty second side Then reverse again finish emptying the first side. Make sure you have read instructions or follow use suggestions for the particular extractor model your are using Start honey removal slowly and gradually increase speed. Fast rotation at first will result in cracked and broken combs.

Extractors are equipped with a honey gate. Honey is drained off and poured into a settling tank In commercial systems pumps drain off honey automatically. At this point, the honey is usually filtered through fine strainer, supported on a hardware cloth cone, to remove coarse materials Allow honey to settle in a warm room and undesired materials will float to the top Jars or cans may be filled directly from the settling tank This honey, unheated, may be called unfiltered or raw honey

Liquid honey is sold most often in 8 ounce or 1, 2 and 5 pound containers The products must be labeled as to weight and producer If the major floral source is known, it may be designated on the label to increase the consumers interest in the product. Standard-sized and shaped bottles are available usually from beekeeping supply companies However, small packers may use containers which can be found locally

Give consideration to packages made of treated cardboard, especially if furnished with plastic lids. Consumers, generally, react favorably to an attractive package with a high quality product, which may save them several cents per pound in packaging costs

Creamed honey is honey that has been allowed to granulate into very fine crystals Honey granulates best at 57°F When mixed with crystaline honey and placed in a refrigerator at this temperature, liquid honey will form crystals in just a few days. Creamed honey may be preferred by customers looking for a product less likely to drip. This is helpful for parents with small children

Hobbyist and back-yard beekeepers are in an excellent position to market the product they produce on a local basis With a small sign, a little local advertising, and a roadside operation, many beekeepers have sold large amounts of honey from their backdoor at a profit This is better than giving honey away, for it does not undermine the local market price. And it provides revenue for the beekeeper for improvements in his beekeeping hobby.

EXPANDING THE BEEKEEPING OPERATION

For the hobbyist beekeeper, expansion from 2 or 3 colonies to a larger operation should involve careful consideration. Most backyards should have no more than 3, 4 or 5 colonies or problems with neighbors will result. Additional colonies should be moved to an agricultural or marginal land apiary location. This requires some type of vehicle to move equipment back and forth from the apiary location to the home.

But at some point in a growing operation, the beekeeper's spouse will "suggest" the beekeeper move out of the kitchen or basement, and the need for a honey house will increase Such a structure often requires plumbing, heating, and insulation.

Increasing equipment and bees

Increasing the size of the operation by purchasing new equipment and packages of bees can be very expensive Thus, most beekeepers look for used equipment and established bee yards to purchase. All equipment should be clean and sound. All hive materials must have a certificate from the Ohio Department of Agriculture regarding disease inspection. Prices generally are negotiated prior to closing of the sale. Where yard locations are concerned, the buyer should contact the landowner regarding continued use of the location and any contingent terms

Beekeepers with 50 to 250 colonies are called sideline operators. They usually have a full time job in a factory, teaching, or similar position. A number are retirees. All have a flexible work schedule which allows them to take off time in the spring, summer, and fall months, as needed, to manage the bee operation. As such, it can be an important second income.

BEEKEEPING SUPPLY COMPANIES

New beekeeping equipment is available from several dealers. Here is a partial list:

The A. I. Root Company, Medina, Ohio 44256

Dadant and Sons, Inc., Hamilton, Illinois 62341

The W. T. Kelley Company, Clarkson, Kentucky 42726

Hubbard Apriaries, Onsted, Michigan 49265

In addition, beekeeping supplies are handled by Sears Roebuck and Wards Farm and Garden catalogues.

These concerns will help you contact a package bee dealer and queen supplier. It is important that you make arrangements for packages and queens several months prior to your anticipated need.